

PBEEEP

State Government

Public Buildings Enhanced Energy Efficiency Program

SCREENING RESULTS FOR MINNESOTA JUDICIAL CENTER



June 9, 2011

Campus Overview

Minnesota Judicial Center	
Location	25 Rev. Dr. Martin Luther King Jr. Blvd., St. Paul, MN
Facility Manager	Gordon Specht
Number of Buildings	1
Interior Square Footage	252,275 (from B3)
PBEEEP Provider	Center for Energy and Environment (Gustav Brändström)
State's Project Manager	Harvey Jaeger
Date Visited	January 11, 2011
Annual Energy Cost	\$332,337 (from 2010 utility data)
Utility Company	District Energy St. Paul (Hot and Chilled Water), Xcel Energy (Natural Gas and Electricity)
Site Energy Use Index (EUI)	69 kBtu/sq ft (from 2010 utility data)
Benchmark EUI (from B3)	105 kBtu/sq ft

The Minnesota Judicial Center is a five story building built in 1990. It houses courtrooms, offices for judges and staff, and a library. There is a floor plan of the building at the end of this report. It includes the Minnesota Supreme Court and the Minnesota Court of Appeals.

Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively short (1 to 5 years) and certain payback. The screening of the Minnesota Judicial Center was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A walk-through was conducted on January 11, 2011 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and their potential for recommissioning. This report is the result of that information.

Recommendation

A detailed investigation of the energy usage and energy savings opportunities of the Minnesota Judicial Center is not recommended at this time. The floor area listed in the table has not been verified.

Building Name	State ID	Area (sq ft)	Year Built
Minnesota Judicial Center	G0231012462	252,275	1990

There are many factors that are part of the decision to recommend an energy investigation of a building; at the Minnesota Judicial Center some of the characteristics that would indicate the facility is a good candidate for recommissioning are:

- Large square footage
- Level of control by the building automation system
- Equipment size and quantity
- Support from the staff and management to include building in an investigation

Although the building staff are clearly supportive of an energy investigation and would like to further reduce energy use at their facility, the energy use at the site is simply too low for a recommissioning study to be certain of delivering cost-effective savings. Recommissioning is focused on low-cost and no-cost measures that typically involve control changes and other minor adjustments to equipment operation. The Energy Use Index (EUI) for the Minnesota Judicial Center is 69 kBtu/sq ft. This is a low EUI and indicates that the staff has already identified the majority of short payback items. In addition, the staff has already implemented many good ideas, and continue to pursue others to reduce their energy consumption.

Potential Energy Reduction Measures and Existing Problems

Although the building is not a good candidate for an energy investigation, there were some potential measures and existing problems identified during the screening that may result in energy savings if resolved. The building staff is aware of these issues and they are listed below:

- All terminal units are pneumatically controlled and therefore do not report back to the main AHUs on space temperatures. With better control of the terminal units, better control of the AHUs is possible.
- The spaces seemed very warm during the walk-through, a 20°F day, and it could quite possibly be because of the lack of automation in the spaces. The additional controls would make temperature setpoints global and night setbacks would be possible.
- The exhaust fans, and associated MAUs if applicable, are very expensive to run when AHUs are not operating since it produces uncontrolled infiltration. The exhaust fans should only be run whenever necessary.
- The two AHUs serving the north side of the building were running at almost 100% speed during a mild day, while the two south units were running at 50%. The two north units should be investigated to see why they are running so hard.
- The outside air temperature sensor for the building BAS seems to be out of calibration. The weather station in St Paul says it was 37°F outside while the BAS says 31°F. This difference really makes a difference when it comes to heating and cooling lockouts, and for economizer operation.

Mechanical Equipment

There are a total of 10 air handlers located throughout the building. Most of the air handlers are variable air volume (VAV). The air handlers use hot water, chilled water, and humidification to condition the air. There are in excess of 110 VAV boxes with HW reheat in the spaces. There are also an unknown number of fan-powered VAV boxes serving areas like courtrooms and conference rooms, most likely not in excess of 30 units.

The heating and cooling of the building is supplied by District Energy and the heating water is isolated from the Capitol Campus loop by heat exchangers. The Plant Management Department regulates when hot water and chilled water is available to the buildings on the Capitol Campus.

There are many exhaust fans of varying size, from 235 cfm to 18,000 cfm, which serve mainly electrical and mechanical rooms, and bathrooms. Two units serve the kitchen and are connected to a Makeup Air Unit.

The following table lists the key mechanical equipment in the Minnesota Judicial Center.

Mechanical Equipment Summary Table	
1	Building Automation System (Honeywell EBI)
1	Buildings
252,275	Interior Square Feet
10	Air Handlers
110+	VAV Boxes <i>(The exact total was not determined in the screening process as it is not available on any documentation.) Many are NOT on the automation system.</i>
40	Exhaust Fans
2	Unit Heaters
3	Low Pressure Steam Boilers for humidification
10	Pumps (HW, CHW, etc)
1	Heat Exchangers
3	Computer Room Air Condition Units
260	Approximate number of points available to be trended

Controls and Trending

The building runs on a Honeywell EBI R310.1 Building Automation System (BAS), which is part of the State Capitol Complex system. The Plant Management Division (PMD) of the Department of Administration controls the BAS.

Lighting

The majority of interior lighting is 32 watt T8s. Most spaces are switched by manual switches.

Energy Use Index and B3 Benchmark

The site Energy Use Index (EUI) is 69 kBtu/sqft. This is 34% lower than the B3 Benchmark of 105 kBtu/sqft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks. This indicates that the Minnesota Judicial Center does not have much potential to further reduce its energy use as other State buildings.

Metering

The Minnesota Judicial Center has one electric, one hot water, and one chilled water meter. The district energy meters are used by Plant Management to bill for the HW and CHW use in the building.

Documentation

There is a significant amount of mechanical documentation, including building plans, equipment schedules, operations and maintenance manuals, and control sequences available on-site.

Building Summary Table

The following tables are based on information gathered from interviews with facility staff, a building walk-through, automation system screen-captures, and equipment documentation. The purpose of the tables is to provide the size and quantity of equipment and the level of control present in each building. It is complete and accurate to the best of our knowledge.

Minnesota Judicial Center					
State ID# G0231012462					
Area (sq ft)	252,275	Year Built	1990	EUI/Benchmark	69.0/105.2
HVAC Equipment					
Air Handlers (7 Total)					
Description	Type	Size	Notes		
S-1	VAV – Joy Fan	SF 17,500 cfm, 20 hp, RF 17,000 cfm, 7.5 hp	Serves above ground floors, NW Part. Has 90 lbs/hr Humidifier.		
S-2	VAV – Joy Fan	SF 17,500 cfm, 20 hp, RF 17,000 cfm, 7.5 hp	Serves above ground floors, SW Part. Has 90 lbs/hr Humidifier.		
S-3	VAV – Joy Fan	SF 21,000 cfm, 25 hp, RF 20,000 cfm, 7.5 hp	Serves above ground floors, NE Part. Has 105 lbs/hr Humidifier.		
S-4	VAV – Joy Fan	SF 21,000 cfm, 25 hp, RF 20,000 cfm, 7.5 hp	Serves above ground floors, SE Part. Has 105 lbs/hr Humidifier.		
S-5	VAV – Joy Fan	SF 24,500 cfm, 25 hp, RF-A 11,500 cfm,3 hp RF-B 11,500 cfm,3 hp	Serves entire basement. Has 220 lbs/hr Humidifier. Return fans have VIGV.		
S-6	VAV	SF 14,900 cfm, 20 hp RF 14,500 cfm, 5 hp	Serves Courtrooms. VFD on SF. Has Fan Powered VAVs.		
S-7	VAV	SF 8,000 cfm, 7.5 hp RF 7,600 cfm, 3 hp	Serves Dining room. VFD and VIGV on SF and RF, respectively.		
S-8	VAV	SF 4,800 cfm, 3 hp RF ?? cfm, ?? hp	Serves West Building North area. Has VIGV on both fans.		
S-9	VAV	SF 2,600 cfm, 1.5 hp RF ?? cfm, ?? hp	Serves West Building South area. Has VIGV on both fans.		
S-10	CV Fan coil	SF 1,500 cfm, 1 hp	Serves Electrical Room.		
Humidification Boiler (3 total)					
Description	Type	Size	Notes		
B1, B2, B3	Humidification Boilers	3X 150 kW, 450 lbs/hr	5 Stages of heat each, 10psi steam. Only one run at any given time.		
Hot Water System					
Description	Type	Size	Notes		
HE 1A and 1B	Heat Exchanger	95 gpm Primary, 300gpm Secondary	Serves District HW to internal HW system.		
HE 2	Heat Exchanger	10 gpm primary, 2 gpm Secondary	Serves as boiler feed water preheat system.		
AC Units System					
Description	Type	Size	Notes		
AC1	AC - Liebert	12,000 cfm, 7.5 hp, 20 tons	Serves Computer room G12		
Liebert	AC - Liebert	30 tons	Serves Computer room		
AC2	AC - Liebert	1.8 tons	Serves rare Books B29		

HVAC Equipment Cont'd

VAVs (110 Total)

Description	Type	Size	Notes
Type 1	VAV	50-125 cfm	
Type 2	VAV	126-250 cfm	
Type 3	VAV	251-375 cfm	
Type 4	VAV	376-550cfm	
Type 5	VAV	551-700 cfm	
Type 6	VAV	701—950cfm	
Type 7	VAV	951-1,200 cfm	
Type 8	VAV	1,201-1,700 cfm	
Type 9	VAV	1,701-2,200 cfm	

Fan Powered VAV (Unknown total)

Description	Type	Size	Notes
Unit 1	VAV	1,400 cfm, ½ hp	
Unit 2	VAV	1,400 cfm, ½ hp	
Unit 3	VAV	1,420 cfm, ½ hp	
Unit 4	VAV	1,420 cfm, ½ hp	
Unit 5	VAV	2,240 cfm, (2X) 1/3 hp	
Unit 6	VAV	750 cfm, 1/3 hp	
Titus 1-6	VAV	700-1,500 cfm	

Exhaust Fans (40 Total)

Description	Type	Size	Notes
30 EFs	Exhaust Fan	235-2,500 cfm, 1/20-1/2 hp	Serves misc rooms, electrical closets, garage, conference rooms.
E1	Exhaust Fan	3,740 cfm, ¾ hp	Serves central bathrooms.
E2	Exhaust Fan	1,200 cfm, 1/3 hp	Serves private bathrooms.
E3	Exhaust Fan	2,540 cfm, ¾ hp	Serves private bathrooms.
E4	Exhaust Fan	5,100 cfm, 3 hp	Kitchen exhaust hood.
E5	Exhaust Fan	2,300 cfm, 1½ hp	Kitchen exhaust hood.
E7	Exhaust Fan	3,060 cfm, 1½ hp	Serves Stairwells
E8	Exhaust Fan	18,000 cfm, 5 hp	Serves basement mech room.
EF 101	Exhaust Fan	3,015 cfm, 1 hp	
EF 102	Exhaust Fan	1,645 cfm, 1/3 hp	
G1	Gravity Relief Hood	14,000 cfm	

UH (2 total)

Description	Type	Size	Notes
UH 101	Unit Heater	1/8 hp, 1100 cfm, 3.3 gpm, 32 kBtu/h	
UH 102	Unit Heater	1/8 hp, 1100 cfm, 3.3 gpm, 32 kBtu/h	

Hot Water Heaters

Description	Type	Size	Notes
WH1	Water Heater	24 kW	
WH2	Water Heater	24 kW	
WH3	Water Heater	36 kW	
WH4	Water Heater	36kW	

HVAC Equipment Cont'd

Pumps (10 Total)

Description	Type	Size	Notes
HWP-1A	Pump	450 gpm, 15 hp	Primary HW Pump
HWP 1B	Pump	450 gpm, 15 hp	Primary HW Pump
RWP- 2A	Pump	150 gpm, 5 hp	Radiation Pump
RWP- 2B	Pump	150 gpm, 5 hp	Radiation Pump
CWP1A	Pump	1000 gpm, 25 hp	Chilled Water Pump
CWP 1B	Pump	1000 gpm, 25 hp	Chilled Water Pump
CP1	Pump	1.5 gpm, 1/3 hp	Condensate pump. Each AHU with humidifier has a small condensate pump also.
FWP1	Pump	3 gpm (ea), 1/3 hp (ea)	Boiler feed water
RWP-A	Pump	75 gpm, 3hp	Radiation Pump
RWP-B	Pump	75 gpm, 3hp	Radiation Pump

Points on BAS

Air Handlers

Description	Points
S1-9	OA Damper Pos, Min OA Damper Position Setpoint, DAT and Setpoint, DSP and Setpoint, RAT, RA RH, RA RH Setpoint, MAT, MAT Setpoint, RF Speed, Space Static Pressure and Setpoint, Humidifier Output, SF-S and Speed, Cooling Valve Pos, Heating Valve Pos, Economizer Status, Lockout Temp
S10	OA, Supply, Space Temp, Min OA Damper Setpoint, OA Damper Pos, Economizer, Lockout Temp, Cooling Valve Pos, SF-S, DAT, DAT Setpoint, RAT
Fan Coil Unit	Space Temp, Economizer Damper Position, Economizer Lockout Temp, SF-S, DAT and Setpoint

Hot Water System

Description	Points
East Radiation West Radiation	District Loop Valve Position, Radiation HWST and Setpoint, Rad HWRT, HW Pump Status and OAT Enable Setpoint
Main Hot Water	District Loop Valve Position, HWST and Setpoint, HWRT, HW Pump Status and OAT Enable Setpoint

Chilled Water System

Description	Points
	Capitol Loop CHWST, CHWRT and Setpoint, CLG Valve Position, Pump Status and Speed, Pump By-Pass Valve Status, CHW DP and Setpoint, OA Valve Enable Setpoint, OA Pump Enable Setpoint

Judicial Misc

Description	Points
System	Temp Control Air Compressor, Heat Exchanger Air Compressor, Rare Book Room Temp and RH, Computer Room #145 Temp and RH, West Rad D/N, East Rad D/N, Humidity Boiler Make up Temp Set, Humidity Boiler Makeup Temp
Lighting	Canopy and Misc Outside lights Status, SW Exit Lighting Status, North Plaza Lights Status

PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	hp	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
cfm	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH